

## CLAIMS

1. A driving apparatus for driving a single-phase or multiple-phase motor having a rotor provided with a magnet and a stator provided with one or more driving  
5 coils, characterized by having:
- synchronizing reference signal generating means which generates a synchronizing reference signal specified as a basic operation time unit;
  - driving control means which controls an energizing  
10 to said driving coils in synchronization with said synchronizing reference signal;
  - terminal voltage detecting means which detects a terminal voltage value on arbitrary one or more phases in said driving coils;
  - 15 terminal voltage holding means which holds the voltage value detected by said terminal voltage detecting means;
  - operation period setting means which sets a period that said driving control means is conditioned to be non-  
20 drive on at least one phase of said driving coils and a period that said terminal voltage detecting means is conditioned to be operative during the period in the non-drive condition; and
  - synchronous control means which compares, on the  
25 same phase, a difference between the voltage value detected by said terminal voltage detecting means and the voltage value held in said terminal voltage holding means with a reference value, and controls a frequency of said synchronizing reference signal on the basis of a result  
30 of the comparison.

2. The motor driving apparatus according to claim 1,  
wherein said synchronous control means corrects, when a  
speed difference of an operation speed of said rotor from  
an arbitrarily determined rated synchronous speed is  
5 caused, said reference value depending on the speed  
difference.

3. The motor driving apparatus according to claim 1,  
wherein said synchronous control means outputs an  
10 abnormality detection signal when an abnormality was  
detected on the basis of said result of the comparison  
during a rated synchronous operation.

4. The motor driving apparatus according to claim 1,  
15 wherein said terminal voltage holding means is composed  
of two systems including a system of holding a positive-  
side terminal voltage value and a system of holding a  
negative-side terminal voltage value.

20 5. A motor driving apparatus for driving a single-  
phase or multiple-phase motor having a rotor provided  
with a magnet and a stator provided with one or more  
driving coils, characterized by having:

drive output means which supplies a drive current  
25 to said driving coils;

power-supply voltage supply means which supplies a  
power-supply voltage to said drive output means;

terminal voltage detecting means which detects a  
terminal voltage value on arbitrary one or more phases in  
30 said driving coils;

terminal voltage holding means which holds the

voltage value detected by said terminal voltage detecting means;

operation period setting means which sets a period that a driving control means is conditioned to be non-  
5 drive on at least one phase of said driving coils, and a period that said terminal voltage detecting means is conditioned to be operative during the period in the non-drive condition; and

synchronous control means which compares, on the  
10 same phase, a difference between the voltage value detected by said terminal voltage detecting means and the voltage value held in said terminal voltage holding means with a reference value, and controls the power-supply voltage of said power-supply voltage supply means on the  
15 basis of a result of the comparison.

6. The motor driving apparatus according to claim 5, wherein said synchronous control means corrects, when a speed difference of an operating speed of said rotor from  
20 an arbitrarily determined rated synchronous speed is caused, said reference value depending on the speed difference.

7. The motor driving apparatus according to claim 5,  
25 wherein said synchronous control means outputs an abnormality detection signal, when an abnormality was detected on the basis of said result of the comparison during a rated synchronous operation.

30 8. The motor driving apparatus according to claim 5, wherein said terminal voltage holding means is composed

of two systems including a system of holding a positive-side terminal voltage value and a system of holding a negative-side terminal voltage value.

- 5 9. A driving method of driving a single-phase or multiple-phase motor having a rotor provided with a magnet and a stator provided with one or more driving coils, characterized in that:

in a process of a transition to a rated operation  
10 mode or after the transition to the rated operation mode, a level of a back electromotive force generated in said driving coils is detected, a phase error is detected by comparing a last detected level with a present detected level on the same phase, and a frequency of a  
15 synchronizing reference signal specified as a basic operation time unit or a power-supply voltage supplied to a drive output unit of the driving coils is controlled on the basis of a result of the comparison.

- 20 10. A mobile terminal mounted with a vibrating motor that includes a single-phase or multiple-phase motor having a rotor provided with a magnet and a stator having one or more driving coils and applies vibrations to a casing, and a motor driving apparatus for driving said  
25 vibrating motor at the time of a reception, characterized in that:

said motor driving apparatus has:

- synchronizing reference signal generating means  
which generates a synchronizing reference signal  
30 specified as a basic operation time unit;  
driving control means which controls an energizing

to said driving coils in synchronization with said synchronizing reference signal;

terminal voltage detecting means which detects a terminal voltage value on arbitrary one or more phases in  
5 said driving coils;

terminal voltage holding means which holds the voltage value detected by said terminal voltage detecting means;

operation period setting means which sets a period  
10 that said driving control means is conditioned to be non-drive on at least one phase of said driving coils and a period that said terminal voltage detecting means is conditioned to be operative during the period in the non-drive condition; and

15 synchronous control means which compares, on the same phase, a difference between the voltage value detected by said terminal voltage detecting means and the voltage value held in said terminal voltage holding means with a reference value, and controls a frequency of said  
20 synchronizing reference signal on the basis of the result of the comparison.

11. A mobile terminal mounted with a vibrating motor that includes a single-phase or multiple-phase motor  
25 having a rotor provided with a magnet and a stator provided with one or more driving coils and applies vibrations to a casing, and a motor driving apparatus for driving said vibrating motor at the time of a reception, characterized in that:

30 said motor driving apparatus has:  
drive output means which supplies a drive current

to said driving coils;

power-supply voltage supply means which supplies a power-supply voltage to said drive output means;

terminal voltage detecting means which detects a  
5 terminal voltage value on arbitrary one or more phases in said driving coils;

terminal voltage holding means which holds the voltage value detected by said terminal voltage detecting means;

10 operation period setting means which sets a period that a driving control means is conditioned to be non-drive on at least one phase of said driving coils, and a period that said terminal voltage detecting means is conditioned to be operative during the period in the non-  
15 drive condition; and

synchronous control means which compares, on the same phase, a difference between the voltage value detected by said terminal voltage detecting means and the voltage value held in said terminal voltage holding means  
20 with a reference value, and controls the power-supply voltage of said power-supply voltage supply means on the basis of the result of the comparison.